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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/849,537	05/07/2001	Tonglong Zhang	1875.0370000	7984

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[REDACTED] EXAMINER

LEWIS, MONICA

ART UNIT	PAPER NUMBER
2822	

DATE MAILED: 02/27/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)
	09/849,537	ZHANG ET AL.
	Examiner	Art Unit
	Monica Lewis	2822

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) Responsive to communication(s) filed on 07 May 2001.
 2a) This action is FINAL. 2b) This action is non-final.
 3) Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) Claim(s) 1-37 is/are pending in the application.
 4a) Of the above claim(s) 18-37 is/are withdrawn from consideration.
 5) Claim(s) _____ is/are allowed.
 6) Claim(s) 1-17 is/are rejected.
 7) Claim(s) _____ is/are objected to.
 8) Claim(s) 18-37 are subject to restriction and/or election requirement.

Application Papers

- 9) The specification is objected to by the Examiner.
 10) The drawing(s) filed on _____ is/are: a) accepted or b) objected to by the Examiner.
 Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
 11) The proposed drawing correction filed on _____ is: a) approved b) disapproved by the Examiner.
 If approved, corrected drawings are required in reply to this Office action.
 12) The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
 a) All b) Some * c) None of:
 1.) Certified copies of the priority documents have been received.
 2.) Certified copies of the priority documents have been received in Application No. _____.
 3.) Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
 * See the attached detailed Office action for a list of the certified copies not received.
 14) Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
 a) The translation of the foreign language provisional application has been received.
 15) Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s). _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

1. This office action is in response to the application filed May 7, 2001.

Election/Restrictions

2. Restriction to one of the following inventions is required under 35 U.S.C. 121:
 - I. Claims 1-17, drawn to a ball grid array package, classified in class 257, subclass 738.
 - II. Claims 18-37, drawn to the method of assembling a ball grid array package, classified in class 438, subclass 1+.

Inventions II and I are related as process of making and product made. The inventions are distinct if either or both of the following can be shown: (1) that the process as claimed can be used to make other and materially different product or (2) that the product as claimed can be made by another and materially different process (MPEP § 806.05(f)).

Because these inventions are distinct for the reasons given above and have acquired a separate status in the art as shown by their different classification, restriction for examination purposes as indicated is proper.

A telephone call was placed to Jeffrey S. Weaver on January 30, 2002 which resulted in a provisional election being made with traverse to prosecute the invention of a ball grid array package, claims 1-17. Affirmation of this election must be made by applicant in replying to this Office action. Claims 18-37 are withdrawn from further consideration by the examiner, 37 CFR 1.142(b), as being drawn to a non-elected invention.

Information Disclosure Statement

3. The listing of references in the specification is not a proper information disclosure statement. 37 CFR 1.98(b) requires a list of all patents, publications, or other information submitted for consideration by the Office, and MPEP § 609 A(1) states, "the list may not be incorporated into the specification but must be submitted in a separate paper." Therefore, unless the references have been cited by the examiner on form PTO-892, they have not been considered.

Drawings

4. The drawings are objected to as failing to comply with 37 CFR 1.84(p)(4) because of the following: a) reference character "506" has been used to designate both opening and wire bonds (See Paragraph 55); and b) reference character "116" has been used to designate both encapsulant and encapsulate (See Paragraph 53). A proposed drawing correction or corrected drawings are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

Claim Objections

5. Claims 2, 3, 6, 9, 11 and 14-17 objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form.

Claim Rejections - 35 USC § 112

6. Claims 1-17 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. It is not clear what is meant by the following: a) "outside an outer dimensional profile" (See Claim 1); and b) "outer profile of said heat spreader overlaps with an inner profile" (See Claim 3). Claims 2 and 4-17 depend directly or indirectly from a rejected claim and are, therefore, also rejected under 35 U.S.C. 112, second paragraph for the reasons set above.

Claim Rejections - 35 USC § 102

7. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

8. Claims 1, 4-6, 8 and 9, as far as understood, are rejected under 35 U.S.C. 102(a) as being anticipated by Li (U.S. Patent No. 6,163,458).

In regards to claim 1, Li discloses the following:

- a) a substrate (10) that has a first surface and a second surface (See Figure 2);
- b) a heat spreader (50) that has a first surface and a second surface, wherein said first heat spreader surface is attached to said second substrate surface (See Figure 2);
- c) a plurality of solder balls (16) attached to said second substrate surface outside an outer dimensional profile of said heat spreader (See Figure 2); and
- d) second heat spreader surface is configured to be coupled to a printed circuit board (PCB) (20) (See Figure 2).

In regards to claim 4, Li discloses the following:

a) second heat spreader surface is plated with solder that allows said second heat spreader surface to be surface mounted to soldering pads on the PCB (See Column 2 Lines 9-10).

In regards to claim 5, Li discloses the following:

a) substrate has a window opening (See Figure 2).

In regards to claim 6, Li discloses the following:

a) an integrated circuit (IC) die that is mounted to said first heat spreader surface and is accessible through said window opening (See Figure 2).

In regards to claim 8, Li discloses the following:

a) die has a surface that includes a ground contact pad (See Figure 2); and
b) a ground wire bond (40) that couples said ground contact pad to said first heat spreader surface (See Figure 2).

In regards to claim 9, Li discloses the following:

a) second heat spreader surface is coupled to a ground potential of the PCB (See Figure 2).

Claim Rejections - 35 USC § 103

9. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all

obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

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10. Claims 2 and 3, as far as understood, are rejected under 35 U.S.C. 103(a) as being unpatentable over Li (U.S. Patent No. 6,163,458) in view of Kalidas et al. (U.S. Patent No. 6,084,777).

In regards to claim 2, Li fails to disclose the following:

- a) a metal ring attached to said first substrate surface.

However, Kalidas et al. ("Kalidas") discloses a semiconductor device where a stiffener (13) is attached to the substrate surface (12) (See Figure 2). It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the semiconductor device of Li to include a stiffener attached to the substrate surface as disclosed in Kalidas because it increases the rigidity of the package.

In regards to claim 3, Li fails to disclose the following:

- a) outer profile of said heat spreader overlaps with an inner profile of said metal ring.

However, Kalidas discloses a semiconductor device where the heat spreader overlaps with the stiffener (See Figure 2). It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the semiconductor device of Li to include an overlap between the heat spreader and stiffener as disclosed in Kalidas because an electrical connection is made to the heat spreader, which serves as a ground plane, that aids in reducing resistance in the package.

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11. Claims 7, 11 and 12, as far as understood, are rejected under 35 U.S.C. 103(a) as being unpatentable over Li (U.S. Patent No. 6,163,458) in view of Chia et al. (U.S. Patent No. 6,002,169).

In regards to claim 7, Li discloses the following:

- a) die (30) has a surface that includes a contact pad (32) (See Figure 2).

In regards to claim 7, Li fails to disclose the following:

a) a wire bond that couples said contact pad to a corresponding metal trace on said first substrate surface.

However, Chia et al. ("Chia") discloses a semiconductor device where the wire (140) couples a contact pad (123) corresponding to a trace (115) on the substrate (135) (See Figure 2). It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the semiconductor device of Li to include a semiconductor device where the wire couples a contact pad corresponding to a trace on the substrate as disclosed in Chia because it permits an electrical connection to be made among components in the device.

In regards to claim 11, Li fails to disclose the following:

- a) integrated circuit (IC) die that is mounted to said first substrate surface.

However, Chia discloses a semiconductor device where the chip (120) is connected to the substrate surface (135) (See Figure 2). It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the semiconductor device of Li to include a die mounted to a substrate surface as disclosed in Chia to connect the chip to a printed circuit board or other peripheral components.

In regards to claim 12, Li discloses the following:

- a) die has a surface that includes a contact pad (See Figure 2);

In regards to claim 12, Li fails to disclose the following:

- a) a wire bond that couples said contact pad to a corresponding metal trace on said first substrate surface.

However, Chia discloses a semiconductor device where the wire couples a contact pad corresponding to a trace on the substrate (See Figure 2). It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the semiconductor device of Li to include a semiconductor device where the wire couples a contact pad corresponding to a trace on the substrate as disclosed in Chia to establish an electrical connection to the components in the device.

12. Claim 10, as far as understood, is rejected under 35 U.S.C. 103(a) as being unpatentable over Li (U.S. Patent No. 6,163,458) in view of Davies et al. (U.S. Patent No. 5,901,041).

In regards to claim 10, Li fails to disclose the following:

- a) substrate is a tape substrate.

However, Davies et al. ("Davies") discloses a semiconductor device where the substrate is a tape substrate (See Abstract). It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the semiconductor device of Li to include a tape substrate as disclosed in Davies because it aids in improving electrical performance by reducing electrical parasites.

13. Claim 13, as far as understood, is rejected under 35 U.S.C. 103(a) as being unpatentable over Li (U.S. Patent No. 6,163,458) in view of Chia et al. (U.S. Patent No. 6,002,169) and Desai et al. (U.S. Patent No. 6,166,434).

In regards to claim 13, Li fails to disclose the following:

a) die is mounted to said first substrate surface in a flip chip configuration, wherein a conductive bump on an active surface of said IC die is connected to a conductive pad on said first substrate surface.

However, Desai et al. ("Desai") discloses a semiconductor device where the die (100) is mounted via solder balls (104) to the substrate (106) (See Figure 1E). It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the semiconductor device of Li to include a semiconductor device where the die is mounted via solder balls to the substrate as disclosed in Desai to form an electrical connection among components.

14. Claims 14 and 15, as far as understood, are rejected under 35 U.S.C. 103(a) as being unpatentable over Li (U.S. Patent No. 6,163,458) in view of Chia et al. (U.S. Patent No. 6,002,169), Desai et al. (U.S. Patent No. 6,166,434) and Kalidas (U.S. Patent No. 6,084,777).

In regards to claim 14, Li fails to disclose the following:

a) a metal ring attached to said first substrate surface.

However, Kalidas discloses a semiconductor device where a stiffener is attached to the substrate surface (See Figure 2). It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the semiconductor device of Li to include a stiffener attached to the substrate surface as disclosed in Kalidas to increase the rigidity of the package.

In regards to claim 15, Li fails to disclose the following:

- a) outer profile of said heat spreader overlaps with an inner profile of said metal ring.

However, Kalidas discloses a semiconductor device where the heat spreader overlaps with the stiffener (See Figure 2). It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the semiconductor device of Li to include an overlap between the heat spreader and stiffener as disclosed in Kalidas because an electrical connection is made to the heat spreader, which serves as a ground plane, that aids in reducing resistance in the package.

15. Claim 16, as far as understood, is rejected under 35 U.S.C. 103(a) as being unpatentable over Li (U.S. Patent No. 6,163,458) in view of Chia et al. (U.S. Patent No. 6,002,169), Desai et al. (U.S. Patent No. 6,166,434), Kalidas (U.S. Patent No. 6,084,777) and Davies et al. (U.S. Patent No. 5,901,041).

In regards to claim 16, Li fails to disclose the following:

- a) a second heat spreader attached to a non-active surface of said IC die and a second surface of said metal ring.

However, Davies discloses a semiconductor device where the heat spreader (18) is attached to the heat sink (42) and die (12) (See Figure 3). It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the semiconductor device of Li to include a heat spreader that is attached to the heat sink and die as disclosed in Davies because it removes excess heat from the package.

16. Claims 17, as far as understood, is rejected under 35 U.S.C. 103(a) as being unpatentable over Li (U.S. Patent No. 6,163,458) in view of Chia et al. (U.S. Patent No. 6,002,169), Desai et al. (U.S. Patent No. 6,166,434) and Davies et al. (U.S. Patent No. 5,901,041).

In regards to claim 17, Li fails to disclose the following:

a) a via that extends through said substrate, wherein said via is filled with a conductive material to couple said conductive bump to said heat spreader.

However, Davies discloses a semiconductor device which utilizes vias (See Column 2).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the semiconductor device of Li to include vias as disclosed in Davies to establish an electrical connection among the components in the device.

Conclusion

17. The following prior art made of record and not relied upon is considered pertinent to applicant's disclosure: a) Mertol (U.S. Patent No. 6,011,304) discloses a stiffener ring attachment with holes; b) Niwa (U.S. Patent No. 5,998,241) discloses a semiconductor device which includes a tape carrier and heat spreader; c) Shim et al. (U.S. Patent No. 5,905,633) discloses a ball grid array semiconductor package; d) Wilson et al. (U.S. Patent No. 5,572,405) discloses a thermally enhanced ball grid array package; e) Johnson (U.S. Patent No. 5,883,430) discloses a thermally enhanced flip chip package; f) Lo et al. (U.S. Patent No. 5,691,567) discloses a heat spreader/heat slug structure; g) Wyland (U.S. Patent No. 5,986,885) discloses a semiconductor with an internal heatsink; h) Chen (U.S. Patent No. 6,077,724) discloses multi-chips semiconductor package; i) Wu (U.S. Patent No. 6,162,659) discloses a heat spreader for integrated chips; j) Dordi (U.S. Patent No. 5,835,355) discloses a tape ball grid array with a

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metal stiffener; k) Sterns et al. (U.S. Patent No. 6,160,705) discloses a ball grid array package using enhanced power and ground distribution circuitry; l) Wang et al. (U.S. Patent No. 5,977,626) discloses a thermally enhanced PBGA package; and m) Nagarajan et al. (U.S. Patent No. 6,133,064) discloses a flip chip ball grid array package.

18. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Monica Lewis whose telephone number is 703-305-3743. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl Whitehead, Jr. can be reached on 703-308-4940. The fax phone number for the organization where this application or proceeding is assigned is 703-308-7722 for regular and after final communications. Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.

ML
February 22, 2002

Carl Whitehead
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